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VOLTAGE SUPPLIES FOR THE MASS SPECTROGRAPH

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VOLTAGE SUPPLIES FOR THE MASS SPECTROGRAPH

By Wilfrid Rall and A. E. Shaw

Two DC voltage supplies are needed for the double focussing mass spectrograph, an accelerating voltage of up to 30,000 volts and a deflecting voltage of up to 3500 volts.

A very convenient 35 kv high voltage supply made to order by the Continental X-Ray Corporation of Chicago, is illustrated in Figure 1. It is mounted in oil in a welded steel case. The 35 kv transformer is rated at 10 ma and was tested at 25% overvoltage. The secondary is 26,000 ohms and will stand shorting. Neither end is grounded and the mounting will stand 80 kv. Placing the condenser across the output caused electrical break-down in the bakelite mounting brackets and Mykroy had to be used. The special 8.5 volt, 14 amp filament transformer is insulated from the high voltage transformer. The rectifier is a KR-6, GE-X-Ray Kenotron.

The input of the high voltage transformer is controlled by means of a type 200-CU Variac whose input is stabilized by a 500 VA, 4.35 amp Sola Constant Voltage transformer. The output is smoothed by a 0.5 microfarad oil-filled condenser rated at 37,500 volts DC, and a surge resistor of 100,000 ohms at 200 watts. The voltage is measured on a 0-1 milliammeter in series with 30 megohms supplied by six 5 megohm Taylor High Voltage Type Shallcross resistors. A 50 megohm 100 watt, type MVR, IRC High Voltage resistor has also been found satisfactory.

The small AC ripple need not be removed because much larger fluctuations are superimposed upon the accelerating voltage by the high frequency spark circuit. The position of a line on the photographic plate is determined by the electrostatic deflecting voltage and the magnetic field. The requirement on the accelerating voltage is only that the energy range of ions produced include the ions which will pass into the 90° condenser without being deflected too much or too little to get through.

A convenient deflecting voltage supply with regulation adequate for ordinary analytical work has been designed by the Instrument Section of the Metallurgical Laboratory. The regulation of this supply is achieved by means of a special saturating reactor and is good to between 1 part in 500 to 1 part in 1000. The output is filtered by a Pi filter as shown. Neither side of the output was grounded since better focus is obtained when the ground potential surface in the condenser is near the middle. It was found worth while to run a series of tests to determine the best point of the dropping resistor to be grounded. The voltage was read on a 0-1 milliammeter which could be connected to read either 2500 or 5000 volts full scale.

The resolution of a double focussing mass spectrograph depends on the regulation of the deflecting voltage supply. When optimum resolution is desired for careful mass measurement, it was found advantageous to replace this supply with a less convenient but more stable set of 45 volt Mini-max batteries in series. Visibly sharper lines were obtained.

Several electronically regulated supplies have been tried but found to be troublesome because of RF pick-up. Recently the Instrument Section constructed a 3500 volt supply in which most of this has been filtered out, but it has not yet been tested enough to be compared with the supply described above. However, the saturating reactor regulator has been found very satisfactory for ordinary analytical work.

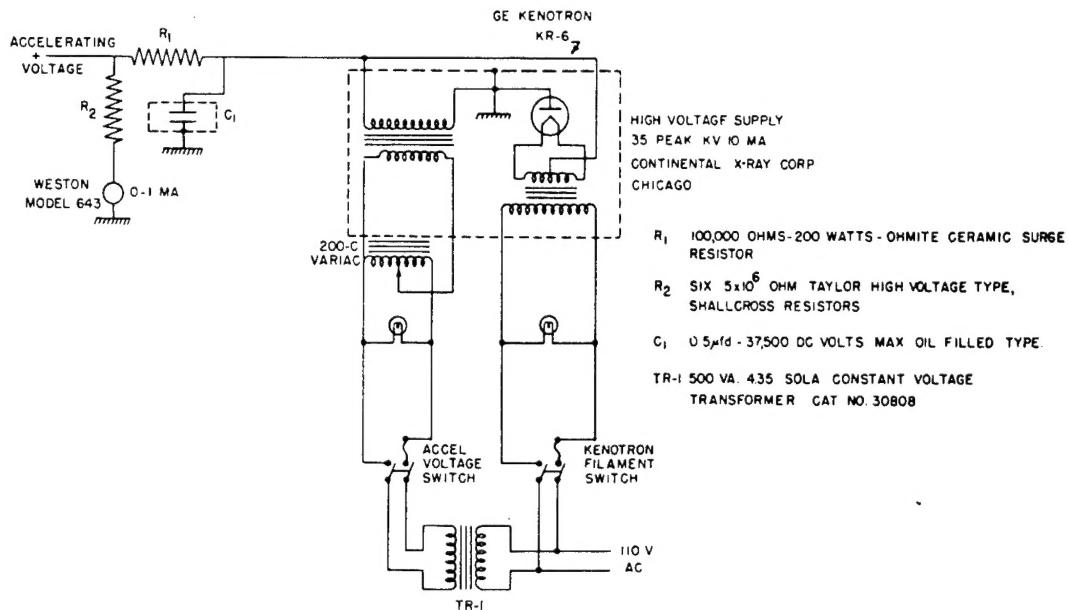


Figure 1. Accelerating voltage supply for mass spectrograph.

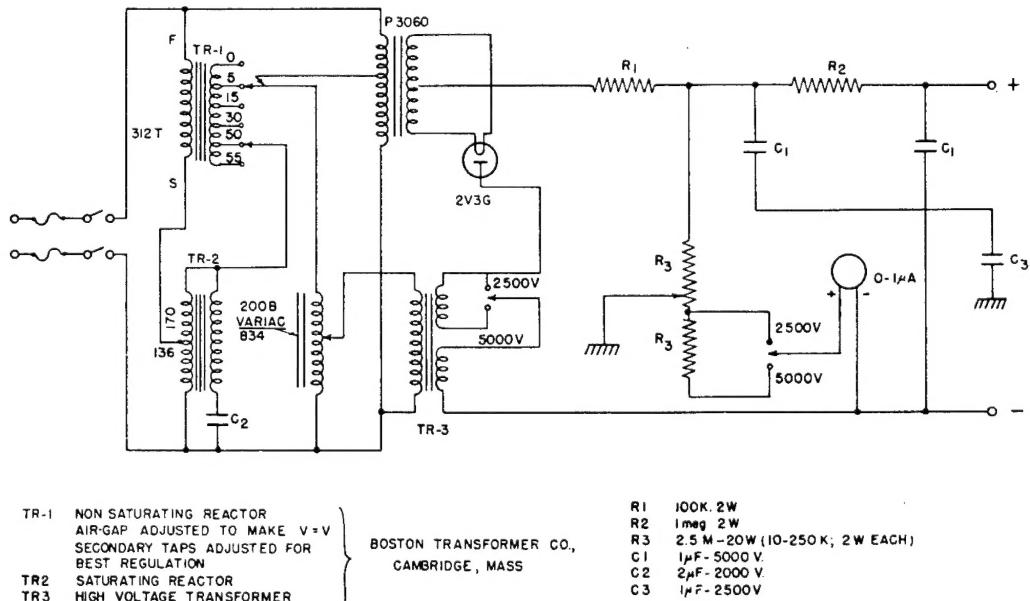


Figure 2. 5000 volt regulated power supply.